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ANN BAVENDER*
ANNE GOODWIN CRUMP*
VINCENT J. CURTIS, JR.
RICHARD J. ESTEVEZ
PAUL J. FELDMAN
ERIC FISHMAN
RICHARD HILDRETH
FRANK R. JAZZO
ANDREW S. KERSTING*
KATHRYN A. KLEIMAN
EUGENE M. LAWSON, JR.
HARRY C. MARTIN
J. TODD METCALF*
GEORGE PETRUTSAS
LEONARD R. RAISH
JAMES P. RILEY
KATHLEEN VICTORY
HOWARD M. WEISS

* NOT ADMITTED IN VIRGINIA

FLETCHER, HEALD & HILDRETH, P.L.C.

ATTORNEYS AT LAW

11th FLOOR, 1300 NORTH 17th STREET

ROSSLYN, VIRGINIA 22209-3801

(703) 812-0400

TELECOPIER

(703) 812-0486

INTERNET

office@fhh-telcomlaw.com

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

FRANK U. FLETCHER
(1939-1985)
ROBERT L. HEALD
(1956-1983)
PAUL D.P. SPEARMAN
(1936-1982)
FRANK ROBERSON
(1936-1961)
RUSSELL ROWELL
(1948-1977)

RETIRED
EDWARD F. KENEHAN

CONSULTANT FOR INTERNATIONAL AND
INTERGOVERNMENTAL AFFAIRS
SHELDON J. KRYS
U. S. AMBASSADOR (ret.)

OF COUNSEL
EDWARD A. CAINE*
JOHN JOSEPH SMITH*

WRITER'S DIRECT

0429

August 27, 1997

VIA HAND DELIVERY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

Re: RM No. 9147

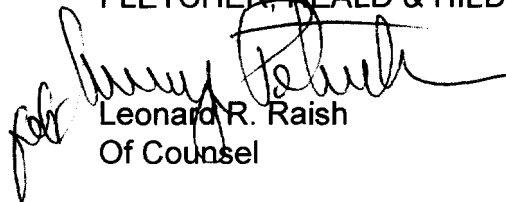
Dear Mr. Caton:

On behalf of the Fixed Point-to-Point Communications Section of the Telecommunications Industry Association, we are filing an original and four (4) copies of its Comments on the above-referenced petition.

Please communicate with us if you need further information.

Very truly yours,

FLETCHER, HEALD & HILDRETH, P.L.C.


Leonard R. Raish
Of Counsel

GP:cej
Enclosures

cc: Phillip L. Spector (w/enc.)

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BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

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In the Matter of)
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Amendment of Parts 2.106 and 25.202)
of the Commission's Rules to Permit) RM No. 9147
Operation of NGSO FSS Systems)
Co-Frequency with GSO and)
Terrestrial Systems in the)
10.7-12.7 GHz, 12.75-13.25 GHz,)
13.75-14.5 GHz, and 17.3-17.8 GHz)
Bands, and to Establish Technical Rules)
Governing NGSO FSS Operations)
in these Bands)

To: The Commission

**COMMENTS OF THE FIXED POINT-TO-POINT
COMMUNICATIONS SECTION OF THE
TELECOMMUNICATIONS INDUSTRY ASSOCIATION**

Respectfully submitted

FIXED POINT-TO-POINT COMMUNICATIONS
SECTION NETWORK EQUIPMENT DIVISION
OF THE TELECOMMUNICATIONS
INDUSTRY ASSOCIATION

Denis Couillard, Chairman
Fixed Point-to-Point Communications
Section Network Equipment Division of the
Telecommunications Industry Association

Eric Schimmel, Vice President
Telecommunications Industry Association

Of Counsel:

Leonard Robert Raish
Fletcher, Heald & Hildreth
1300 North 17th Street - 11th Floor
Rosslyn, Virginia 22209
(703) 812-0400

Date: August 27, 1997

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SUMMARY

SkyBridge LLC ("SkyBridge") has proposed amendment of Sections 2.106 and 25.202 of the Commission's Rules to permit operation of nongeostationary orbit fixed satellite systems on several microwave bands on a "co-frequency" basis with the geostationary orbit fixed satellite, the geostationary orbit direct broadcast satellite, and the terrestrial point-to-point microwave services. The Fixed Point-to-Point Communications Section of the Telecommunications Industry Association ("TIA"), which represents major manufacturers of microwave radio equipment, is concerned about and offers comments on the proposals concerning the 10.7-12.2, 14.4-14.5, and the 17.7-17.8 GHz microwave bands. Those bands currently accommodate in a major way terrestrial fixed microwave systems. Briefly, it is TIA view that, while SkyBridge shows an awareness of the needs of fixed terrestrial microwave users, and offers some novel approaches to addressing the historical difficulty of terrestrial and satellite systems sharing the same spectrum, TIA believes that the underlining premise of SkyBridge's proposal that the proposed satellite system can operate without interference to and from terrestrial microwave networks raises several technical issues that need to be clarified prior to proceeding to Rulemaking action. The Commission is urged to seek information either from SkyBridge direct or through a Notice of Inquiry on how the proposed SkyBridge operation would protect future growth of Fixed Service operations.

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COMMENTS OF THE FIXED POINT-TO-POINT COMMUNICATIONS SECTION OF THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

The Fixed Point-to-Point Communications Section of the Telecommunications Industry Association ("TIA"),¹ submits these Comments on the above-captioned Petition for Rulemaking ("Petition"), filed with the Commission on July 3, 1997, by SkyBridge LLC ("SkyBridge").²

INTRODUCTION

SkyBridge requests amendment of Sections 2.106 and 25.202 of the Commission's Rules to permit operation of nongeostationary orbit fixed satellite systems ("NGSO FSS") in the 10.7-12.7, 12.75-13.25, 13.75-14.5 and the 17.3-17.8

¹TIA is the principal association representing fixed point-to-point microwave radio equipment manufacturers. TIA members serve all segments of the U.S. telecommunications industry, including telephone carriers, utilities, railroads, state and local governments, and cellular carriers licensed by the Commission to use microwave frequencies for the provision of essential telecommunications services. TIA members also market microwave equipment worldwide.

²Public Notice of the filing of the Petition was given on July 28, 1997. Report No. 9147.

GHz bands,³ on a “co-frequency” basis with certain services. These services include the geostationary orbit fixed satellite service (“GSO FSS”), geostationary broadcast satellite service (“GSO BSS”), and terrestrial fixed point-to-point services (“FS”) now authorized in those bands.⁴

³SkyBridge also has pending before the Commission an application (and an amendment thereto also filed on July 3, 1997) for authorization to operate a low earth orbit (“LEO”) NGSO FSS system essentially as proposed in the Petition. SkyBridge proposes to provide, among other services, high speed Internet access and video conferencing for direct reception to the public using small consumer antennas. Petition fn 1, pp 1-2. Hereafter, referenced is made to SkyBridge’s application as the “Application” and to the July 3, 1997, amendment as the “Amendment”.

⁴The bands sought by SkyBridge are now allocated as follows:
10.7-11.7 GHz: FS and FSS (space-to-earth). Use of the band for fixed satellites is subject to Notes S5, 441, U.S. 211 and NG 104. Under these notes, the use of this band for satellite communications is limited to international systems (NG 104), and it is also subject to Appendix 30B of the ITU Radio Regulations with respect to the 10.7-10.95 and 11.2-11.45 MHz portions of the band.

11.7-12.2 GHz: FS and FSS, and it is subject to Notes 839 and G142 and 145. Note 839 limits FSS use to national and subnational systems.

12.2-12.7 GHz: Direct Broadcasting-Satellite Service (DBSS) and subject to Notes 839. This band is limited to national and subnational DBSS systems and is governed by Appendix 30A in Region 2 by the ITU Radio Regulations.

12.75-13.25 GHz: Auxiliary Broadcast Cable Relays, including mobile TV Pickup and FS. (FSS is also shown on the national allocations, but not in the service allocations. See, 47 C.F.R. 2.106 (1996, p. 420.) To the extent this band is available to FSS, it is limited to international systems by Note NG 104. This band is also governed by Appendix 30B of the ITU Radio Regulations.

13.75-14.0 GHz: FSS (Earth-to-space) subject to Notes S5, 333, S5, 502, 503 and 503A which (a) recognize Radiolocation as a secondary service and (b) impose power density limitation on earth stations.

14.0-14.5 GHz: FSS (Earth-to-space) with secondary suballocations for FS, Aviation and Marine.

17.3-17.8 GHz: FSS, FS, Auxiliary Broadcast Cable, TV Relay.

As detailed herein, TIA has serious concerns regarding the ability of FS and NGSO FSS users to share the same band. While TIA appreciates SkyBridge's innovative proposal to accommodate such sharing, its Petition nonetheless raises the following material issues that must be resolved:

- It is unclear if SkyBridge's proposed operation in the 10.7-11.7 GHz band (the "11 GHz Band") will protect the ability of FS users to expand their operations so they can meet increasing demand for providing access to urban centers with high capacity links. Thus, before the Commission can adopt the Petition and institute a formal rulemaking, SkyBridge must be required to address the questions contained herein regarding its capability to deploy earth stations with coordination zones that would permit FS expansion in the 11 GHz band. SkyBridge can amend its Petition with this information. Alternatively, the Commission can issue a Notice of Inquiry inviting SkyBridge and other interested parties to evaluate the proposed 11 GHz band coordination criteria and to suggest alternative criteria.
- It is unclear how SkyBridge will address its deployment of User Terminals in the 14-15 GHz band, which is inconsistent with the FS use of this band in ITU Regions 1 and 3.
- It is unclear how SkyBridge's 17.7-19.7 GHz band operation would be coordinated with FS and other users.

FS USERS MUST BE PROTECTED

The members of TIA are interested in this proceeding because of its potential impact on the future deployment of terrestrial fixed services here and abroad. Portions of the bands where SkyBridge seeks authority to operate, particularly the 10.7-11.7, 14.4-14.5, and 17.7-17.8 GHz bands, increasingly are being heavily used by FS. Thus,

N.B.: The 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz (in Region 2), and 13.75-14.5 GHz bands are in the unplanned FSS, and are subject to S22.2.

TIA, its members, and their customers are vitally interested in the sharing proposals SkyBridge sets out in its Petition. This interest is acute because FS operations consistently are being relocated from the “2 GHz” band to higher bands (i.e., “6 GHz”, “10-11 GHz”, and “18 GHz” bands) to make way for Personal Communications Service (“PCS”) and Mobile Satellite Service (“MSS”) services.

SkyBridge claims that NGSO FSS systems, such as that proposed in its Application, would not cause any noticeable degradation to the quality or availability of FS communications facilities (as well as to GSO FSS systems) and would not impose any operational restrictions on FS operations (as well as on GSO FSS operations). However, TIA is not as comfortable with that conclusion as is SkyBridge, particularly with respect to future availability of the 11 GHz band for FS use.

Sharing between FS systems and satellite earth terminals has a rocky history. The forcing out of FS users in the domestic 4 GHz (“C”) band is a sad example.⁵ TIA welcomes SkyBridge’s attempt to mitigate what has been a difficult technical problem. The Application, as amended, shows an unusual respect for existing FS users. Consequently, this proposal should be explored further. Nevertheless, TIA still is not as

⁵Based upon their experience in the 4 GHz band, FS users could not accept sharing with satellite carriers. Historically, the 4 GHz band was allocated exclusively for FS. However, the Commission reallocated this band so that satellite earth stations could operate with FS on a co-primary basis. This reallocation had been predicated on satellite user representations that such sharing would work. Regrettably, it has not. A large number of licensed satellite earth stations have been installed over the years around existing 4 GHz microwave systems. Since the earth stations are much more susceptible to interference than terrestrial microwave, it is almost impossible to coordinate new 4 GHz FS paths in many urban areas. Even in rural areas, the frequency coordination process can be expensive since it may require on-site inspections of earth stations and field measurements to determine local shielding. Thus, the 4 GHz band de facto has become unavailable for FS users.

optimistic as SkyBridge that the proposed interference avoidance techniques indeed would adequately protect existing or future FS facilities.

**THE IMPACT OF THE SKYBRIDGE PROPOSAL ON
FUTURE SPECTRUM AVAILABILITY FOR FS
SYSTEMS WOULD BE SUBSTANTIAL**

SkyBridge proposes the following band plan:

	Uplink	Downlink
Service Links	12.75-13.25 GHz	10.7-12.75 GHz
Infrastructure Links	13.75-14.5 GHz	10.7-12.7 GHz
TT&C Links	17.3-17.8 GHz	

A. 11 GHz Band

Under this plan, SkyBridge would use the FS 10.7-11.7 GHz band for downlink communications with its Gateway stations.⁶ SkyBridge plans to deploy thirty such Gateway stations in the Continental United States. Each Gateway would serve user terminals in a “Gateway Cell” with a radius of 350 km or 220 miles. This Gateway station would be frequency coordinated so as to be compatible with existing FS systems, and future FS would have to be coordinated to be compatible with and avoid interference to existing Gateway stations.

Depending on where the 30 Gateway cells are located (but assuming that they would be located near population and business centers), these cells would cover most, if not all, of the urban centers in the United States. The deployment of Gateway stations and the need to provide them with protection against interference substantially

⁶The SkyBridge proposed system consists of a constellation of 64 LEO satellites organized into identical 32-satellite sub-constellations. The purpose of these satellites is to relay messages from so-called “User-Terminals” to “Gateway” stations, which in turn would connect into FS networks. See also Amendment Figure 3, paragraph 9.9.

would restrict the 10.7-11.7 GHz band for future FS communications.

Demand for FS in the 11 GHz band is substantial and is experiencing substantial growth. There are now more than 16,000 FS stations licensed in the 10.7-11.7 GHz band.⁷ TIA doubts seriously that this band would accommodate the proposed new satellite service as well as terrestrial and GSO FSS operations.⁸ Note is taken, however, that “user terminals” will be placed in an adjacent 11.7-12.0 GHz band which are described as small terminals with minimal interference protection. TIA believes a frequency guard band (depending upon the user terminal receiver characteristics) may be necessary to avoid fixed and satellite system interaction near 11.7 GHz.

B. 17.7-19.7 GHz Band

The 17.7-17.8 GHz band is part of the larger 17.7-19.7 GHz band, which is extensively shared by a great variety of services, including satellite and FS operations. SkyBridge plans to use this band for “Infrastructure”, “Service”, and “TT&C” links.⁹ SkyBridge has not explained how the use of this band would be coordinated with existing and future users. In any event, TIA doubts that this band can accommodate yet another satellite operation without displacing incumbents.

⁷See, FCC “Spectrum Inventory Table, 137 MHz to 100 GHz”. October 1996.

⁸As noted above (n. 2), the 10.7-11.7 band is restricted to the operation by international satellite communication systems. As also noted above (n. 4), the objective of the SkyBridge system is to relay messages to and from the Gateway and User Terminals within the same 350 km radius Gateway Cell. This service is clearly not international. Thus, in addition to frequency availability issues, it appears that the SkyBridge proposal may be inconsistent with the restriction on the use of the 11 GHz band for domestic satellite communications.

⁹See, Application, Section IV, for a definition of these terms.

C. 14 GHz Band

SkyBridge plans to operate the ubiquitous User Terminals in the 14 GHz band to avoid other congested FS bands. While that strategy may take into account the United States FS users, it would not avoid the problem in other countries where the 14-14.5 GHz band range are used for FS systems. Several U.S. manufacturers do have interests in that international usage since they build 14 GHz equipment for export in several markets abroad. In those areas, the User Terminals/terrestrial microwave conflict would not be avoided.

**FREEZING OUT OF
FS SYSTEMS IS A MAJOR CONCERN
AND MUST BE ADDRESSED
BEFORE A RULEMAKING IS ADOPTED**

FS systems would be, in effect, frozen out of geographic areas near earth stations.¹⁰ The issue is that satellite earth stations have unusually stringent (relative FS systems) interference protection requirements. Unlike FS systems, satellite earth stations typically coordinate an entire band at all azimuths and force other services to provide them very stringent interference protection. Any measures required to protect the earth station are the responsibility of the new FS user. Often, nothing can be done to satisfy the satellite earth station user. Once a satellite system is in place in a geographic area, it tends to obstruct the entry of new FS systems into the same geographic area. This area may extend more than 100 miles from earth stations. For obvious reasons, such constraints would be intolerable for FS users.

To avoid this problem, SkyBridge proposes "[w]ith respect to coordination with

¹⁰See, e.g., Curtis, H.E., "Interference between Satellite Communications Systems and Common Carrier Surface Systems," Bell System Technical Journal, May 1962, pages 921-943.

terrestrial links constructed subsequent to the siting of such a gateway facility, the burden should be shared, with both the NGSO operator and the terrestrial operator mutually obligated to employ reasonable interference avoidance techniques.”¹¹

SkyBridge must clarify and justify this approach. Typically, a FS path costs in the hundreds of thousands of dollars. The Gateway Terminals costs are in the millions. One Gateway Terminal can obstruct hundreds of potential FS systems. It is TIA’s view that while FS users have a responsibility to use good frequency engineering practices, the cost thereof should be borne by the earth station user.

SkyBridge suggests that maximum FS/NGSO FSS coordination distances can be 8 km or even 0.8 km with some assumptions on FS system and Gateway Terminal characteristics.¹² While this is an intriguing idea, in TIA’s experience, the coordination distances are closer to 200 kilometers. Thus, substantially more technical detail is needed to analyze SkyBridge’s proposal.

As detailed below, TIA seriously questions whether SkyBridge’s proposal will permit FS expansion in the 11 GHz band. Before the Commission proceeds to rulemaking, this problem must be thoroughly addressed the satisfaction of FS users.

**PETITIONER’S EXPECTATIONS THAT THE
PROPOSED NGSO FSS SYSTEMS WOULD
OPERATE WITHOUT INTERFERENCE TO AND FROM
TERRESTRIAL FS NETWORKS ARE UNDULY OPTIMISTIC**

A. SkyBridge Interference Analysis: FSS to FS

(1) Long Term Interference

SkyBridge asserts that its proposed NGSO system would not cause any

¹¹See Petition at Page 17.

¹²See Amendment, Appendix C, pages 21 and 22.

interference or would impose any operational constraints on FS operations. TIA has reviewed the extensive technical interference analyses SkyBridge has presented in its Application to support this assertion.¹³ TIA's conclusions, however, differ from SkyBridge's.

While the I/N ratio determined by SkyBridge would provide the required protection to FS systems against long term interference in the 10.7-11.7 GHz band by a comfortable margin, the calculations¹⁴ on SkyBridge uses for its conclusions do not appear entirely correct. For example, draft ITU-R Recommendation F.758¹⁵ provides a receiver thermal noise floor for current digital receivers at -130 dBw in a 10 MHz bandwidth or -140 dBw/MHz. That is a 4 dB more sensitive to interference than the tightest number used by SkyBridge (-136 dBw/MHz). SkyBridge's analysis overlooks the gain of the victim receiver antenna of the FS station. Moreover, it appears that, for determining long term interference, SkyBridge assumes that the satellite segment would radiate into the sidelobes (10° or more of elevation) of the FS receiving antenna.¹⁶ Therefore, the corresponding FS antenna sidelobe gain must be taken into account, which, when the antenna is tilted 2° upward (usually necessary to counter multipath), corresponds to the antenna gain at an 8° elevation, or approximately 17

¹³See Amendment to Application, pp. 21 and 22; Petition pp. 17-20.

¹⁴See July 3, 1997 Amendment to the SkyBridge Applications, Appendix C, p. 19.

¹⁵See, e.g., Draft Revision of Recommendation ITU-R F.758, Table 13, Document 9/B2/14, June 16, 1997.

¹⁶Amendment, Appendix C, p. 14, Figures C-5 and page 16.

dBi.¹⁷ It thus appears that the Interference Power Density (I) would be -176.7 dBW/MHz and the Receiver Noise Power Density (N) would be -140 dB/MHz, giving a long-term I/N ratio of -36.7 dB, which is 21 dB worse than the I/N figure calculated by SkyBridge.

It also appears that the satellite signal is not Nyquist filtered¹⁸ in that the signal would be filtered at the receiver end of each link. Since SkyBridge apparently plans to employ multiple beams and since unfiltered signals have poor selectivity characteristics, TIA believes that adjacent channel interference also must be taken into account in evaluating probable interference to a microwave FS receiver. A factor of 3 dB should be used, resulting in a less optimistic I/N ratio of -33.7 dB. TIA notes in this particular case, the revised figure would still meet the relevant I/N objective by a good margin.

(2) Short Term Interference

As is the case for the long term analysis, a -140 dBW/MHz value should be used to represent the Noise Power Density of the FS receiver. ITU-R Recommendation F.758 also indicates a 51 dBi FS antenna gain, which is 6 dB higher than the figure used by SkyBridge.¹⁹ To that, a factor of 3 dB should be added to take into account interference from adjacent beams. This would result in a revised I/N of +1.4 dB, which does meet the short term interference objectives proposed by SkyBridge,²⁰ but it is 11.4 dB short of meeting the long term interference objective. In light of the essential purposes for which FS systems are used in the United States, microwave operators do

¹⁷This is based on a 30 dB or a 32 dB discrimination at 8° for a 48 dB gain of the HP10-107 antenna manufactured by Andrew Corporation.

¹⁸See, Amendment, pp. 13-14.

¹⁹Amendment, Appendix C, p-18, Table C-12, line 9.

²⁰This is 20 dB I/N for 0.001% of the time. See SkyBridge Application, p. B-42.

not differentiate between short term and long term interference for domestic interference analysis. Thus, for U.S. purposes, the long-term interference expectations should be controlling in determining the feasibility of the SkyBridge proposal. These short duration I/N levels would be a real concern if the industry cannot agree on the short term interference criteria proposed by SkyBridge.

B. SkyBridge Interference Analysis: FS to FSS

SkyBridge's conclusions²¹ with respect to FS to NGSO FSS interference also appear to be overly optimistic. For example, SkyBridge assumes a 25° antenna discrimination of -6 dB. This is not a reasonable assumption since FS towers can be and should be expected to be located at any point around a given Gateway. Under these circumstance, calculations for the worst case interference analysis must take into account the 51 dBi antenna gain assumed in ITU Recommendation F-758. That Recommendation also assumes, as noted above, a FS receiver noise floor at -140 dBw/MHz, not the -136 dBw/MHz figure SkyBridge has used. With an I/N objective of -10 dB, the maximum acceptable FS interference to a SkyBridge Gateway Station receiver becomes -150 dBw/MHz per 4 kHz at 10.7-11.7 GHz between 0 and 5 degrees above the horizontal plane for FS users.

The likely interference, therefore, is $(140-136) + (6 + 51) = 61$ dB worse than the model presented by SkyBridge, which is unfavorable for FS users. Following SkyBridge's reasoning, a revised $133.2 + 61 = 194.2$ dB free space loss attenuation would be required to protect a SkyBridge Gateway, indicating a physical separation close to 320 km. However, taking into account ground absorption for propagation over

²¹See Amendment, Appendix C, pp. 21-22.

long distances for typical antenna heights, this distance probably can be reduced by a factor of 2 for normal propagation conditions, leaving a minimum separation between a FS facility and a Gateway receiving station of at least 160 km.

With deployment of thirty (30) Gateway stations most likely near the population centers, the coordination problems would be staggering. The 11 GHz band is extensively used by terrestrial microwave operators to access urban centers with high capacity systems. Clearly then, should the Commission determine to authorize the SkyBridge proposal, it must impose siting restrictions so that the proposed Gateway Cells are not deployed near urban centers.

CONCLUSION

SkyBridge shows an awareness of FS user needs. It offers some novel approaches to solving the historical difficulty of FS and satellite systems sharing spectrum. Considerably more detailed study still is required to demonstrate the proposed sharing actually will work under operational conditions.

With so many FS operations being relocated from the "2 GHz" band to higher bands in order to accommodate PCS and MSS systems, the 10.7-11.7 GHz band has become considerably more essential to the FS. Still, being optimistic and assuming a 160 kilometer coordination distance, there has to be concern regarding the deployment of 30 Gateways throughout the U.S., which could be more troublesome for SkyBridge is not the only satellite operator to use the 11 GHz band for Gateways in the future.

Since the 11 GHz band is extensively used to access urban centers with high capacity links, adequate protection of FS users is essential. Herein, TIA raises serious questions concerning how the SkyBridge proposal would provide such protection. Establishing viable coordinations criteria is an essential component to solving this


puzzle. Imposing siting restrictions in the location of proposed SkyBridge stations so they are not deployed near U.S. urban centers and require that proper interference mitigation techniques be used.

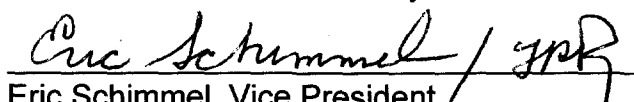
Under these circumstances more information clearly is needed before SkyBridge's sharing proposal can be evaluated fully. In short, before proceeding to Rulemaking, SkyBridge should address and clarify the technical questions raised herein above by TIA. SkyBridge's response to those questions should be included in the Notice of Proposed Rulemaking (NPRM). The NPRM should ask commenters to state in connection with earth station deployment what rules or restrictions should be imposed upon SkyBridge operations to protect future growth of the FS in the 11 GHz band.

TIA urges the Commission to either issue a Notice of Inquiry incorporating the questions raised in the Comments above or to require, as suggested just above, that SkyBridge address the same questions so that the Commission will have the needed information available prior to proceeding to an NPRM.

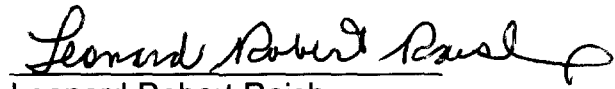
Respectfully submitted

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Telecommunications Industry Association


Eric Schimmel, Vice President
Telecommunications Industry Association

Of Counsel:

A handwritten signature in black ink, reading "Leonard Robert Raish". The signature is written in a cursive style with a large, stylized initial 'L' and a long, sweeping tail that extends to the right.

Leonard Robert Raish
Fletcher, Heald & Hildreth
1300 North 17th Street - 11th Floor
Rosslyn, Virginia 22209
(703) 812-0400

Date: August 27, 1997

cej/gp/gp#7/TIA3.PLEADING